Appendix G8
Air Quality - Air Quality Analysis of Operating Emissions - Ammonia

AVAILABLE ON CD ONLY

Screening HRA for Cabrillo Port Ammonia Slip Emissions
March 9, 2005

Emission Source

Only the Wartsila 9L50DF main generators emit ammonia (slip from SCR). Assuming the three generators are operating simultaneously, ammonia emissions are:

Emission Rates	Units	Acute (hourly)	Chronic (annual)
Ammonia (9L50DF BACT)	lbs	2.43	10,871
Ammonia	g/sec	0.306	0.156

Modeling - SCREEN3 version 96043 was used

Emissions from the three generators are assumed to be emitted from one equivalent diameter stack. Modeling inputs are:

- Source - P (point)
- Actual Emission Rate (g/s) – hourly 0.306 g/sec, annual 0.156 g/sec
- Stack Height (m) – 33
- Stack Diameter (m) - 1.73
- Exit Velocity (m/s) - 53.3
- Gas Temperature (K) - 700
- Ambient Temperature (K) – 293 (default, more conservative)
- Receptor Height (m) - 1.8
- Rural Option used
- Downwash used
- Building Height (m) – 21 (hull)
- Building minimum horizontal dimension (m) – 65 (hull)
- Building maximum horizontal dimension (m) – 286 (hull)
- Complex terrain - No
- Simple terrain with terrain above stack - No (Together these two options result in flat terrain)
- Meteorology - Full meteorology option 1 used
- Automated distance array - Yes
- Distances - 500 to 25,000 m range (safety zone to shoreline)
- Discrete distances – No
- Fumigation - No
- SCREEN3 results for unit emission rate: 2.154 u/m^3 @ 500 m, 0.583 ug/m^3 @ 25,000 m

GLC for actual emission rate	Units	Acute (hourly)	Chronic (annual)
500 meters (safety zone)	ug/m^3	0.66	0.34
25,000 meters (shoreline)	ug/m^3	0.18	0.09

Screening HRA

Averaging Period - EPA Multiplying Factor for point Sources:

- 1 hour: 1.0 (acute)
- 3 hours: 0.9
- 8 hours: 0.7
- 24 hours: 0.4
- Annual: 0.08 (chronic)

Ref: "Screening Procedures for Estimating the Air Quality Impact of Stationary Sources, Revised," EPA-454/R-92-019, page 4-16).

Adjusted GLC	Units	Acute (hourly)	Chronic (annual)
500 meters (safety zone)	ug/m^3	0.66	0.03
25,000 meters (shoreline)	ug/m^3	0.18	0.01

Reference Exposure Level (REL) values from Risk Assessment Procedure for Rules 1401 and 212 Attachment K (Projects after May 2, 2003) Table 8A:

- Ammonia Acute REL (hourly): 3200 ug/m^3
- Ammonia Chronic REL (annual): 200 ug/m^3, multipathway (MP) adjustment is 1.00

Calculation of Hazard Index:

Hazard Index = (Adjusted GLC) (MP) / (REL)

A hazard index of less than 1.00 (unity) is acceptable.

Results

Acute and chronic maximum Hazard Indexes occur 500 m from source (safety zone boundary). Hazard Indexes for 25 km onshore receptor are one order-of-magnitude lower:

Hazard Index	Acute (hourly)	Chronic (annual)
500 meters (safety zone)	2.1E-04	1.3E-04
25,000 meters (shoreline)	5.6E-05	3.6E-05

The results show there is virtually no health risk from ammonia slip emissions from the project (FSRU) since the Hazard Index magnitude is 10^{-4} to 10^{-5}, or 1/10,0000 to 1/100,000.

Ammonia HRA: Release Parameters

Release Parameter	Units	Main Gens	Backup Gen	Vaporizers	Emerg. Pump	Emerg. Gen	Life Boat
Fuel	Type	Dual Fuel	Diesel	Gas	Diesel	Diesel	Diesel
Heat Input	mmBTU/hr	178.21	59.40	460.00	5.85	35.84	0.64
Wet Fd Factor	wscf/mmBTU	10,608	10,320	10,610	10,320	10,320	10,320
Oxygen Content	percent	15%	15%	3%	15%	15%	15%
Exhaust Temperature	Deg F	800	800	70	800	800	800
Stack Diameter	inches	68.2	39.4	78.7	10.0	26.0	3.0
Stack Area	sq. ft.	25.36	8.45	33.82	0.55	3.69	0.05
Stack Flow	wscf/min	111,608	36,194	94,976	3,565	21,835	388
Stack Flow	wacf/min	266,338	86,372	95,336	8,507	52,106	926
Stack Velocity	ft/min	10,502	10,217	2,819	15,597	14,132	18,871

Release Height	meters	33	33	35	25	25	1
Release Diameter	meters	1.73	1.00	2.00	0.25	0.66	0.08
Release Velocity	meters/sec	53.3	51.9	14.3	79.2	71.8	95.9
Release Temperature	degrees K	700	700	294	700	700	700

Downwash Dimensions	Units	FSRU Hull
Height	meters	21
Width (min horizontal)	meters	65
Length (max horizontal)	meters	286

Ammonia HRA: Screen Model Data

Emission Rates	Units	Acute (hourly)	Chronic (annual)
Ammonia (9L50DF BACT)	lbs	2.43	10,871
Ammonia	g/sec	0.306	0.156
OEHHA Reference Exposure Level (REL)	ug/m^3	3200	200
Hazard Index Limit		1	1

GLC for unit emission rate (1 g/sec)	Units	Acute (hourly)	Chronic (annual)
500 meters (safety zone)	ug/m^3	2.154	2.154
25,000 meters (shoreline)	ug/m^3	0.583	0.583

GLC for actual emission rate	Units	Acute (hourly)	Chronic (annual)
500 meters (safety zone)	ug/m^3	0.66	0.34
25,000 meters (shoreline)	ug/m^3	0.18	0.09

EPA-454/R-92-019, page 4-16		Acute (hourly)	Chronic (annual)
Adjustment Factor		1	0.08

Adjusted GLC	Units	Acute (hourly)	Chronic (annual)
500 meters (safety zone)	ug/m^3	0.66	0.03
25,000 meters (shoreline)	ug/m^3	0.18	0.01

Hazard Index	Acute (hourly)	Chronic (annual)
500 meters (safety zone)	2.1E-04	1.3E-04
25,000 meters (shoreline)	5.6E-05	3.6E-05